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II. Observations concerning the Subterraneous Trees in Dagenham, and other Marshes bordering upon the River of Thames, in the County of Essex. By the Revd. Mr. W. Derham, Rector of Upminster in the same County, and F. R. S.

THE *Royal Society* having some time since laid their commands upon me, to give them an account of the *Subterraneous Trees*, uncovered by an Inundation of the River of *Thames* in *Dagenham* and *Havering Marshes*, not far from me; and having lately received a renewal of the same commands, my Duty and great Respects to that most Illustrious Body, oblige me to give the best Relation I can of the Observations I have had some good Opportunities of making about that Matter. And I hope such an Account may be the more acceptable, by reason it hath relation to a different sort of Subterraneous Trees, and a way of interment of them, varying from what is remark'd by two very Ingenious Members of the *Royal Society*, the Right Honourable the Earl of *Cromertie*, and Dr. *Sloane*.

The Inundation happened between Four and Five Years ago, by a Breach in the *Thames* Wall, at an extraordinary high Tide: And by means of the great violence of the Water, a large Channel was torn up, or Passage for the Water of 100 Yards wide, and 20 Foot deep in some Places; and in some more, some less. By which means a great number of Trees were laid bare, that had been there interred many Ages before.

The Trees were all, as far I could perceive, of one sort, except only one, which was manifestly a large Oak, with the greatest part of its Bark on, and some of its Head and Roots. The rest of the Trees the Country People (Carpenters and others) take to be *Yew*: And so did I myself imagine them to be, from the hardness, toughness, and weight of the Wood, notwithstanding we have no *Yew* growing any where thereabouts, and it seem'd strange to me, that *Yew* should grow, in such vast quantities, in such a Soil, and so near the brackish Waters. But a very Ingenious Neighbour of mine, and a Member of the *Royal Society*, D' Acre Barret Esq; convinced me they might more probably be some other Wood, as *Alder*; which grows plentifully by our fresh Water Brooks. And lately he told me, he had the Opinion of an ingenious and good Judge of Wood, who takes it to be *Horn-beam*, which grows plentifully also with us in the higher Lands (but I do not remember to have seen it in watery Places near us) but I rather incline to the Opinion of its being *Alder*; the Grain of the Wood, and manner in which the Boughs grow, &c. much resembling that of *Alder*, more than *Horn-beam*, as the Specimens herewith sent will manifest.

By lying so long under ground, the Trees are become black and hard, and their Fibres are so tough, that one may as easily break a Wire of the same size, as any of those Fibres. This toughness they maintain, if the Wood be kept dry, as I find by two of the Trees I have now by me. But by drying, those Trees are become cracked, and very flawy within, but look sound outwardly, and with difficulty yield to Wedges. But for the Trees lying in the Marshes, which are covered by every Flood, and laid bare by every Ebb, in a short time they became very rotten.

There is no doubt but those Trees grew in the Place where they now lye; and that in vast multitudes; they
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lying so thick upon, or near one another, that in many places I could step from one to another. And there is great reason to think, that not only the Marshes, which are now over-flown (which are about 1000 Acres) are covered underneath with those Subterraneous Trees, but also all the Marshes along by the River side, for several Miles: For we discover these Trees all along the *Thames* side over against *Rainham, Wennington, Purfleet*, and other places: And in the Breach that happened at *West-Thorrock* about 21 Years ago, they were washed out in as great Numbers (as I have been inform'd) and of the same kind of Wood, as those found lately in *Dagenham* and *Haverling Levels*.

These last mentioned Trees are of different sizes; some above a Foot Diameter, some less. As I was rowed in a Boat along the Channel, I met with two of the lesser sort, standing upright, in the same posture in which they grew; their Tops just above Low-Water, and their Bottoms (at least the bottom of the Channel) at 16 Feet depth. We endeavoured to draw them out, but could not do it with all our Strength. They seemed to be about 2 Inches Diameter in their Trunk, had some of their Boughs on, were dead, and in all likelyhood, being young and light, escaped the force of what threw the other more large, and unweildy ones down.

Most of the Trees, that I met with, had their *Roots* on, and many of them their *Boughs*, and some a part of their *Bark*. There was only one that I perceived had any signs of the *Ax*, and its Head had been lopped off.

As I passed the Channel which the Water had torn up, I could see all along the Shores vast Numbers of the *Stumps* of those Subterraneous Trees, remaining in the very same posture in which they grew, with their Roots running some down, some branching and spreading about in the Earth, as Trees growing in the Earth

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commonly are seen to do. Some of those Stumps I thought had signs of the Axe, and most of them were flat at top, as if cut off at the Surface of the Earth : But being rotten, and batter'd, I could not fully satisfy my self, whether the Trees had been cut, or broken off.

The *Soil*, in which all those Trees grew, was a black ouzy Earth, full of the Roots of Reed ; on the Surface of which ouzy Earth the Trees lay prostrate, and over them a Covering of grey Mould, of the self same colour and consistence with the dry Sediment, or Mud, which the Water leaveth behind it at this Day. This Covering of grey Earth is about 7 or 8 Feet thick, in some places 12 Feet or more, in some less ; at which depths the Trees generally lye.

Another thing I took notice of, was the *Posture* in which the Trees lay, which was indeed in no kind of order, but some this way, some that, and many of them across : Only in one or two places I observ'd they lay more orderly, with their Heads for the most part towards the North, as if they had been blown down by a Southerly Wind, which exerts a pretty strong force upon that Shore.

As to the *Age* in which those Trees were interred, it is hard to determine. Many think they have lain in that Subterrane State ever since *Noah's Flood*. But altho' I have not the least doubt but that at this Day we have many Remains of the Spoils of that Deluge, even in the highest Mountains, yet I rather think these Trees to be the Ruins of some later Age, occasioned by some extraordinary Inundations of the River of *Thames*, or by some Storms, which (as I said) blow sharply upon this Shore : Either of which acts of violence might be able to root up, and tumble down Trees growing in so lax a Soil, as these manifestly grew in at that time. And as for extraordinary *Inundations* of the *Thames*,

there is at this Day a Mark, which, if occasioned by an Inundation, was the Mark of an Inundation very prodigious, beyond all ever known to have been in that River; and that it is a *Bed of a Shells*, if not of a kind of Marble too, lying cross the High-way on the Descent near *Stifford-bridge*, going from *S. Okendon*: Of which I shall give a distinct Account at some time of leisure, by reason it would be too great a Digression here to expatiate upon it, as it deserves.

Below this Bed of Shells, at above 50 or 60 Yards distance, in the bottom of the Valley, runneth a Brook, that empties itself into the *Thames* at *Purfleet*, about 3 Miles from thence; which Brook ebbeth and floweth as the *Thames* doth, but not at any certain height, by reason of Mills standing thereon; but above a pretty High-water in the Brook, the Surface of the Bed of Shells I find to lye above 20 Foot perpendicular. Consequently if this Bed of Shells was repositied in that place by an Inundation of the *Thames*, that Inundation must be such as would have drowned a vast deal of the adjacent Country, and have over-topped the Trees by the River, in *West-Thorrock*, *Dagenham*, and the other Marshes, and probably by that means over-turn them.

This I say seems to me the most rational way of accounting for our Subterraneous Trees, and not by the *Universal Deluge*: For had they been left there by that Deluge, we should not find the Bed of Earth, in which they grew, so entire and undisturb'd, as it manifestly is at this Day, a spongy, light, ouzey Soil, full of Reed-roots, as I said; and I assure my self (altho' I never try'd it) of much less Specifick Gravity than the *Stratum* above it is. Whereas I can assure this Curious and most Learned Society (having lately tryed the Experiment my self with competent care and exactness, because I never could be satisfy'd, upon the strictest enquiry, that any body else had done it: I can, I say, assure this Society) that

that in three Places where I have try'd it, the *Strata* are in a surprizing manner, gradually specifically heavier and heavier, the lower and lower they lye. Concerning which Matter, if God granteth me Life and leisure, I intend to give this most Illustrious Society a farther Account, when I have made Experiments enough to fully satisfy my self, and render my Observations fit for the cognizance of so curious and accurate a Body of Naturalists.

Having given this Account of their *Prostration*, let us lastly enquire into the *Manner how these Trees came to be interred*, which is a difficulty more easy to be resolved than the last. And this I take to be from the gradual increase of the Mud, or Sediment, which every Tide of the *Thames* left behind it. I presume those Trees might be thrown down before the Walls or Banks were made, that keep the *Thames* out of the Marshes; and then those Trees were over-flown every Tide. And by reason they lay thick, and near one another on the ground, they would soon gather a great deal of the Sediment, and be soon covered therewith. And after the *Thames*-Walls were made, every Breach in them, and Inundation would leave great quantities of Sediment behind it; as I by a troublesome Experiment found, in going over some of the Marshes, soon after the late Breach, where I found the Mud, generally above my Shoes, and in many places above my Knees. And it is a practice among us (of which we have divers Instances) that where a Breach would cost more to stop, than the Lands over-flown will countervail, there to leave the Lands to the mercy of the *Thames*; which by gradually growing higher and higher, by the Additions of Sediment, will in time shut out the Water of the River, all except the highest Tides. And these Lands they call *Saltings*, when covered with Grass; or else they become *Reed-ground*, &c.

That it was the Sediment of the *Thames*, that burried those Trees, is farther manifest from what I said before, of the likeness of the Earth above them, in all respects, to the Sediment the River now lets fall, when dry ; a Sample of which accompanieth this Paper : Which may be observ'd to consist of many distinct Layers ; some $\frac{1}{2}$ of an Inch thick, some less, and some scarce $\frac{1}{30}$ of an Inch. All which several Layers are, no doubt, the several quantities which every Tide left behind it. This Sediment, when dry'd by the Sun and Wind, becomes tough and hard, and looketh like a grey *Lapis Scissilis*, or *Slate*, divisible into many Plates or Layers. And what if we should ascribe the Conformation of *Slate*, *Muscovia-glass*, and other the like laminated Concretions, to a like work of Nature, by adding new Layers of such Petrifications, and Particles, as the Fossile is made of ?

P. S. I presume there will be no doubt, but that the Subterraneous Wood receives its blackness from Vitriolick Juices in the Earth. If any doubt should be, I have try'd the Experiment, and find that *Alder-Wood*, whether green or old, becomes blackish, much of the same colour as the Wood before-mentioned in this Paper, in a Solution of Copperas. Which is not only an Argument, that the blackness of the Wood is owing to Vitriol, but also that the Wood is *Alder*, or some such like Wood, that will become black with Vitriol : For I am inform'd that all Subterraneous Wood is not black, particularly *Firr*. I have also try'd *Hornbeam* since, after the same manner, and find that also becomes black, as the *Alder* doth.